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# THE FAMILY BLEPHARICERIDAE IN COSTA RICA (DIPTERA)

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The *Science Bulletin* and *Contributions in Science* of the Natural History Museum of Los Angeles County were merged into a single imperial octavo serial, retaining the name *Contributions in Science* and beginning with Number 301.

This serial has been newly formatted for maximum use of typography and illustrations per page, and sized for maximum use of paper. All photography has been produced utilizing a 200-line screen for detail.

Since most institutions rebind *Contributions in Science* collectively into hardbound volumes, and many researchers using them desire to photocopy material, two new features have been incorporated into the new format. A suggested citation line provides the abbreviated serial title, year, number of publication, and total pagination, and appears in the lower left corner of each page; and pages of *Contributions in Science* have been printed off-center to provide a two-inch gutter between adjacent pages for easier accessibility in photocopying.

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# THE FAMILY BLEPHARICERIDAE IN COSTA RICA (DIPTERA)[1]

*By* Charles L. Hogue[2]

ABSTRACT: Five species of net-winged midges of the family Blephariceridae are recorded for Costa Rica. All belong to the genus *Paltostoma;* one was previously known (*delectata* Alexander) but the remaining are described here as new species *(costaricensis, diriageni, exserta* and *zwicki).* The paper includes also a diagnosis and biologic notes on the genus.

The Blephariceridae or "net-winged" midges are notable in the extreme adaptations they exhibit for life in torrential water. Six mid-ventral suckers permit the larvae to hold fast and travel from place to place on smooth rock surfaces in the fastest currents, in waterfalls and cataracts; the pupae are attached permanently to the substratum by ventrolateral adhesive pads. The adults are capable of emergence while totally submersed. This takes place through an explosive egress of the body from the pupal case and unfolding of the appendages, followed by immediate flight. Such rapid escape is made possible by prior development and expansion of the wings and legs within the pupal case. The process requires compression and folding of the complete wing and causes numerous creases to form in its membrane, giving it the reticulate appearance from which the family receives its common name.

Although occurring widely in the Neotropical Region, the Blephariceridae are seldom collected. Consequently, our knowledge of species distributions is fragmentary and the family's regional taxonomy is in a rudimentary state (Hogue 1971). Five genera are presently recognized (including the very primitive *Edwardsina,* with species also in Australia), all apparently having austral origins. Of these, evidently only *Paltostoma* has extended northward through Central America, penetrating Mexico along the Sierra Madre Occidental to latitude 21° N (unpublished record). The genus also occurs on several Caribbean islands.

The Costa Rican fauna includes 5 species. The first known was *delectata,* described by Alexander in 1953 from 2 males, and which, until my recent collecting, remained the sole regional representatives of the family. This paper adds 4 additional species and provides descriptions and illustrations by which all may be recognized. Because little collecting has been accomplished and speciation seems to have occurred between populations that are only narrowly separated geographically, there remain strong possibilities for discovery of still other forms.

The descriptions of the adults are based largely on pharate specimens dissected from their pupal cases. Therefore, measurements of legs and wings, as well as color pattern characters, are not determinable. Quantitative data are given in millimeters and represent means calculated from small samples, hence ranges are omitted. Terminology follows that of Hogue 1973 and 1978.

## *Paltostoma* Schiner

*Paltostoma* presently contains 13 named species, including those newly described in this paper. Material of several more exists in collections and, surely, more will be discovered when streams are sampled in the vast Andean Mountain system. The genus is characterized as follows:

### DESCRIPTIONS

**Adult**

COLORATION: Generally well sclerotized; velvety brown with sharply defined, silvery ("frosty") or opalescent reflections which vary in position depending on the angle of viewing.

SIZE: Small to medium-sized Blephariceridae; wing length 4.5–9 mm.

HEAD: Small. Normal type. Suprafrons very broad, flat; frontal carina absent. Parietal sclerite very narrow. Ocelli sessile, separate, on slightly elevated boss. Eyes disjunct; undifferentiated into upper and lower divisions; ommatidia all of approximately equal size.

MOUTHPARTS: *Male.* — Proboscis very long (PL/HW 2.5). Labium jointed near base. Labrum rigid, slender; apex attenuate. Margin of hypopharynx entire, a few spicules apically. Maxillary lobes very long, approximately half the length of labium. Labellar lobes small, length slightly greater than width of labium. Palpus very short, segments 1–3 fused, 4–5 absent; sensory pit

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of segment 3 terminal. Mandibles absent. *Female*. — Proboscis moderately long (PL/HW 1.4). Labium jointed at about mid-length. Labrum rigid, broad, apex acute. Lateral margin of hypopharynx serrate, apex with lateral hair-like projections. Maxillary lobes short, slightly less than half the length of labrum. Labellar lobes very short, length less than width of labium. Palpus very short, segments 1–3 distinct, 4–5 absent; sensory pit of segment 3 terminal. Mandibles present.

ANTENNA: Length 1.5–1.8 head width, that of male slightly longer proportionately (1.8–1.9); 15-segmented. Scape globular, pedicel canopiform[3], flagellomeres cylindriform, length of latter about 2.0 width; flagellar segments 1–5 each with a small group of placoid sensilla dorsally.

WING: Venation (Fig. 14) reduced: $R_2$, $R_3$, $M_3$, and basal sector of $M_{3+4}$ absent; 1A reduced; $R_{2-5}$ long; branch of $R_4$ and $R_5$ near apex of wing. Dorsal macrotrichia on vein $R_5$ only, a few also ventrally at apex of this vein. Wing shape broad (L/W 2.9), anal lobe moderately developed.

LEGS: Tibial spur formula 0–0–1 in both sexes, hind tibial spur large, minutely spiculate on inner surface. Tarsal segment 5 longer than 4, a group of spiniform setae ventrobasally. Tarsal claws each with a single, large sub-basal tooth.

ABDOMEN: Short, strongly tapered posteriorly.

MALE GENITALIA: Segments VIII and IX unmodified. IXth tergite lobes triangular, a strong ventral armature produced from the lateral margin of each lobe, its arms converging anteriorly. Basistyle elongate, longer than dististyle. Outer dististyle broad, rectangular, variously incised and setose. Inner dististyle undivided, a long, curved, irregular finger. Phallosome vesica triangular; apodeme longer than vesica, a vertical, oval flange. Parameres undeveloped as separate, distinct tubular structures, their morphological position assumed by a broad, apically reflexed plate (''ventral plate''[4] of Stuckenberg 1958:101, see Fig. 9). Penis filaments 3, all simple, very long, straight rods, without special apical modifications. Tegmen narrow, anchor-shaped; base small, forming a shallow subanal pouch; apex broadly spatulate; margin recurved. Lateral portion of ventral bridge (Fig. 8) forming a complex curved plate weakly continuous with the ventral bridge proper.

FEMALE GENITALIA: VIIIth sternite lobe elongate, median fold deep, wide, Oviscapt elongate, apical lobes extended latero-posteriorly, a ventral, transverse Ω-shaped apodeme present in inner piece. Spermathecae ovoid; ducts very long, exit from body of spermatheca laterally, their proximal sections coiled 1 to several times around body before leading to gonotreme. Sensilla of cercus all chaetiform, apical tubular sensilla absent; a short, subapical, ventral finger-like lobe extending posteriorly from the cercus.

CHAETOTAXY: Body without long hairs. Setal groups minimal and inconspicuous. Occipital bristles of head short, scattered and not differentiated into upper and lower series. Postgenal bristles very few (1–3).

**Larva**

Intercalary convexities undeveloped. Head capsule with deep lateral incisions. Antenna short, 2-segmented. Dorsal pseudopods and sclerotized major plates and processes absent. Dorsal integument densely striate. Ventral gill filaments stellate in arrangement, 9–10 (usually 10) in number. Primary trunk sensilla recognizable as follows: **ic** (on anterior margin of division, rather than at level of intercalary portion), short, chaetiform; very small **it** (in normal positions on divisions II–VI); moderately long chaetiform sensilla **st** (P, I–V), **psu** (M–T), **tp** (II–V), **ss** (P–T, in line) and **pd** (I–VI). Secondary sensilla in two fields on dorsum: small, scattered capitate to conoid types generally and similarly shaped but much larger types in linear series antero- and posterolaterally on each division, the latter often flattened and tending to close interlobular spaces dorsally. Terminal setae reduced in size and number to 1–2.

**Pupa**

Elliptical to oval in outline, cross-section hemi-oval, flat. Lateral margins underfolded. Dorsal cuticle of all sclerites except cephalic and alar densely set with long spines; those middorsally flanked basally with 2 or more very short spinelets (spines often lacking in specimens suffering from rough handling or stream abrasion). Respiratory processes erect, disjunct at base; individual plates (lamellae) rigid, triangular, with acute apices; inner plates smaller and weaker than outer. Antennal cases short, extending to a level less than apex of the mouthpart cases. Ventral adhesive pads four in number.

DISTRIBUTION: Restricted to Neotropical Region between latitudes 25° S and 21° N, Pacific Cordillera and Caribbean Islands. See the map (Fig. 40) for the distribution of species in Costa Rica.

## ***Paltostoma costaricensis*** NEW SPECIES

Figures 1–2, 5–9, 25, 27–29, 37, 40

### DIAGNOSIS

This species may be distinguished by the following combination of characteristics of the male genitalia: long penis filaments with gradually widened bases. Broadly rounded, improminent IXth tergite lobe; arms of ventral armatures of the lobes contiguous and fused anteriorly. Outer dististyle incised apicoventrally, the dissected portion forming a thumblike projection.

It is also decidedly smaller than any other Costa Rican *Paltostoma*. Although comparable measurements for most structures are not available because of the lack of fully developed specimens of both sexes of all the species, the fact is readily apparent from general inspection. Head widths and lengths of wing vein $R_5$, characters which could be compared among all species, indicate that *costaricensis* is approximately 20% smaller than either *zwicki* or *delectata* and 40% smaller than *diriageni* and *exserta*.

### DESCRIPTIONS

**Male** (Figs. 1, 5–9)

A composite description, based on four pharate specimens dissected from their pupal cases:

COLORATION: Not determinable, probably similar to that of female (see below).

SIZE: A small *Paltostoma*. Measurements as follows (from 3 pharate specimens): Wing and leg dimensions not determinable. Head width 0.66. Clypeus-labrum length combined 1.76. Palpal segments 1–3 combined 0.20.

HEAD (Fig. 1): Palpal segment proportions indeterminable, fusion of segments 1–3 complete, no perceptible constrictions or joints. Antennal segment proportions 1.3, 1.6, **1.00**, 1.0, 1.1,

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[3] Shape like a typical Egyptian canopic jar.

[4] This homology is questionable, however. Comparative anatomical studies are needed; the term is used here for convenience only.

1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.4. Ultimate segment 1.3 length of penultimate.

LEGS: Segment proportions not available.

WING: Venation and trichia typical for genus.

GENITALIA (Figs. 5–9): IXth tergite lobe improminent, apex broadly rounded; arms of ventral armature contiguous anteriorly. Outer dististyle incised apicoventrally, the dissected ventromedian portion forming a thumb-like projection. Inner dististyle simple, smoothly curved and tapered, slightly capitate. Tegmen elongate, narrow, with two parallel straplike sclerotizations; basal portion narrow, articulating with the contiguous arms of the ventral armature of the IXth tergite lobes. Phallosome totally lacking parameres; penis filaments evenly tapered, only slightly widened basad.

**Female** (Figs. 2, 25)

Based primarily on specimen from Golfito; head structures from Rincón series:

COLORATION: *Head.* — All sclerites medium-brown, darker towards vertex and posteriorly, with extensive velvety texture and silvery opalescent reflections; ocellar triangle dark-brown. Mouthparts and antenna dull medium-brown, the latter darker. *Thorax.* — Generally medium-brown. Scutum, scutellum, anterior pronotum and ventral portions of episternum and meron darker; extensive silvery opalescent reflections as on head; remaining sclerites and membranous portions dull yellow-brown. Disc of scutum with dark-brown, parallel, median vittae separated from a more posterior, broad, V-shaped, dark-brown vitta bordering the transverse suture. *Legs.* — Generally dull medium-brown, lighter basad, darker abruptly distad (before apices of tibiae), including tarsi and claws. *Wing.* — Membrane hyaline; veins brownish-black. *Haltere.* — Stem light-brown basad, darkening distad; knob velvety gray-brown. *Abdomen.* — Color characteristics not available.

SIZE: Measurements as follows (from 5 pharate and one mature specimen): Body length not determinable. Wing length 6.8, width 2.3. Head width 0.84. Clypeus length 0.39. Labrum length 0.67. Palpal segments 2–3: 0.16, 0.22. Leg segment lengths as below (from Golfito specimen):

| | fore | mid | hind |
|---|---|---|---|
| femur | 4.4 | 5.7 | 7.1 |
| tibia | 5.4 | 5.5 | 6.3 |
| tarsus 1 | 1.89 | 2.00 | 2.06 |
| 2 | 0.79 | 0.86 | 0.43 |
| 3 | 0.41 | 0.44 | 0.24 |
| 4 | 0.26 | 0.28 | 0.21 |
| 5 | 0.28 | 0.26 | 0.25 |

HEAD (Fig. 2): Palpus very short, segments 1–3 distinct, proportions 2–3: 1.0, 1.4. Antennal segment proportions: 1.0, 1.5, 1.00, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.1, 1.0, 1.1, 1.8; ultimate segment 1.6 length of penultimate.

LEGS: Progressive segment proportions as below:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| foreleg | 1.0 | 1.2 | 0.4 | 0.4 | 0.5 | 0.6 | 1.1 |
| midleg | 1.0 | 1.0 | 0.4 | 0.4 | 0.5 | 0.6 | 0.9 |
| hindleg | 1.0 | 0.9 | 0.3 | 0.2 | 0.6 | 0.9 | 1.2 |

WING: Venation and trichia typical for genus.

GENITALIA (Fig. 25): Oviscapt broad, ratio length/width = 1.3. Setae of VIIIth sternite lobe short, 10–14 in number.

**Pupa** (Fig. 37)

SIZE: Small. Measurements (N=10): male, length 2.9, width 1.7; female, length 4.3, width 2.5.

STRUCTURE: Outline elongate-oval, L/W 1.7, strongly convex, cross section hemispherical, peripheral margin rounded. Cephalic sclerite strongly underfolded (to level of tips of palpus case). Cuticular spines proportionately long, longest lateral spines about as long or slightly longer than mid-dorsal length of scutellar sclerite; numerous spines in mesoposterior region of scutum; parabasal spinelets, when present, one on each side of the major spine and mostly of equal length. Lamellae of respiratory processes divergent, no. 1 much so, projecting anteriorly beyond body margin; subequal in length; outer pair heavier than inner and triangular; inner pair 0.6–0.7 width of outer at their bases, no. 2 the smallest; apex of no. 3 slightly attenuate and tortuate, curving around inner margin of no. 2.

**Larva** (Figs. 27–29)

SIZE: Small. Measurements (N=10): Body length 5.0; head capsule width 1.26.

CHAETOTAXY (trunk segments only): Secondary dorsal sensilla all small and coniform; those of antero- and posterolateral linear series larger and coniform to clavate, the latter more poorly developed dorsomesad.

STRUCTURE: Pseudopods short, L/W about 2.3, arising from ventrolateral depression. Posterolateral lobe of anal division poorly developed, apex directed caudad. Lateral margin of anal division entire, a cluster of secondary coniform sensilla with large alveoli situated on a slight boss anterior to posterolateral lobe. Posterior extreme of anal segment not excessively pigmented nor sclerotized, the margin a smoothly rounded arc continuous with lateral margin. Ventral integument mesal to base of pseudopod strigose over only a small area immediately mesal to insertion of pseudopod.

MATERIAL AND TYPE LOCALITY:

*Types.* COSTA RICA, *Puntarenas Province,* 1.8 miles W Rincón, Linguita Creek, 11 March 1971, C.L. Hogue and J.P. Donahue: HOLOTYPE ♂ (pharate, dissected from and mounted entire on slide series No. CLH 73–16a–e: LACM); ALLOTYPE ♀ (pharate, dissected from and mounted entire on slide series No. CLH 73–156a–e: LACM); 6♂, 5♀ PARATYPES (pharate adults mounted entire on slide series).

*Additional.* COSTA RICA, *Alajuela Province,* 0.7 miles W Grecia, Río Vigía, 18 June 1972, C.L. Hogue (1 larva: LACM). *Puntarenas Province,* Golfito, 15 August 1957, A.S. Menke (1♀: LACM). Las Cruces, (rock quarry) 6 miles S San Vito de Jabá, Río Jabá, 22 March 1967, R.W. McDiarmid, RWM 21 (2 pupae, 14 larvae: LACM). 27 June 1972, C.L. Hogue (2 pupae, 21 larvae: LACM). 1.8 miles W Rincón, Linguita Creek, 3 July 1963, C.L. Hogue (2 larvae: LACM). 11 March 1971, C.L. Hogue and J.P. Donahue (32 pupae and pupal skins, 24 larvae: LACM).

ETYMOLOGY: The species is named for Costa Rica, its country of origin.

## *Paltostoma delectata* Alexander

Figures 12–14, 30–33, 40

*Paltostoma delectata* Alexander 1958:47. Type locality: Costa Rica, San José Province, Rio Buena Vista, Rivas. Deposited in private collection of C.P. Alexander, Amherst, Massachusetts.

*Paltostoma delectata,* Hogue 1971:8.7.

DESCRIPTIONS

**Male** (Figs. 12–14)

From the original description and the single paratopotype:

COLORATION: *Head.* — Front dull-orange, silvery pruinose, mouthparts pale-brown; remainder of head chestnut-brown, variegated with silvery on the anterior vertex. *Antenna.* — Not determinable. *Thorax.* — Scutum chestnut-brown, including four broad confluent prescutal stripes, leaving broad silvery areas on the posterior pronotum and at the prolongations of the [parapsidal?] "suture." Lateral sclerites yellow. *Legs.* — ". . . coxae and trochanters yellow; forefemora chiefly black, more brightened basally and with a very obscure yellow to scarcely evident subterminal yellow ring; remaining femora yellow, the extreme tips brownish black; foretibiae and tarsi black, the remaining tarsi obscure brownish yellow. . . ." *Wing.* — Membrane hyaline; vein brownish black to black. *Haltere.* — Stem yellow, knob blackened. *Abdomen.* — First tergite yellow, the remainder brown, their extreme bases paler and more or less pruinose. Sternites more extensively yellow, silvery pruinose beneath, the sides infuscated. *Genitalia.* — Dark-brown.

SIZE: Measurements as follows (from paratopotype): Body length 3.5. Wing length 4.9, width 1.9. Head width 0.80. Clypeus-labrum length combined 1.55. Palpal segments 2–3, lengths not available. Leg segment lengths as below:

| | fore | mid | hind |
|---|---|---|---|
| femur | 2.9 | 3.8 | 4.9 |
| tibia | 3.5 | 3.7 | 4.4 |
| tarsus 1 | 1.41 | 1.58 | n.a. |
| 2 | 0.57 | 0.63 | n.a. |
| 3 | 0.27 | 0.30 | n.a. |
| 4 | 0.16 | 0.16 | n.a. |
| 5 | 0.25 | 0.24 | n.a. |

HEAD: Exact palpal segment proportions not determinable from material, but the palpus is very short and similar to that of the other species with two segments (morphologically, segments 2–3 fused). The indistinct intersegmental articulation 2–3, common to this organ in male *Paltostoma,* probably led to Alexander's remark in the original description that the palpus is apparently 1-segmented. Antennal segment proportions: 1.0, 1.1, **1.00**, 1.0, 1.0, 1.1, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.5. Ultimate segment 1.5 length of penultimate.

LEGS: Progressive segment proportions as below:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| foreleg | 1.0 | 1.2 | 0.4 | 0.4 | 0.5 | 0.6 | 1.6 |
| midleg | 1.0 | 1.0 | 0.4 | 0.4 | 0.5 | 0.5 | 1.5 |
| hindleg | 1.0 | 0.9 | n.a. | n.a. | n.a. | n.a. | n.a. |

WING (Fig. 14): Venation and trichia typical for genus.

GENITALIA (Figs. 12–13): IXth tergite lobe prominent, symmetrically triangular, apex broadly acute; arms of ventral armature contiguous cephalad. Margin of outer dististyle entire, obtusely rectangular. Inner dististyle simple, apex slightly spatulate. Tegmen elongate, narrow; apex truncate; basal portion narrow, articulating with the contiguous arms of ventral armature of IXth tergite lobes. Phallosome lacking parameres, longitudinal striae evident in ventral plate; penis filaments short, evenly tapered, only slightly widened basad, basal fourth alveolate.

**Female**

Unknown.

**Pupa** (Not figured)

SIZE: Medium. Measurements (N=5): all females (?), length 5.0, width 3.6.

STRUCTURE: Outline elliptical, L/W 1.4–1.5, compressed, cross section hemilenticular, peripheral margin acute. Cephalic sclerite underfolded only a little more than half the distance to level of tips of palpus cases. Anterior margin of scutellar sclerite shallowly U-shaped. Cuticular spines proportionately long, longest lateral spines slightly longer than middorsal length of scutellar sclerite; only two spines in mesoposterior corner of scutum; parabasal spinelets commonly multiple (2–4) and of unequal length. Lamellae of respiratory processes parallel, erect, subequal in length; outer pair heavier than inner and triangular, inner pair about 0.5 width of outer at their bases; no. 3 the smallest and narrower than no. 2 and set mesad of same; apices of both inner lamellae straight; apices of lamellae no. 4 of each side convergent.

**Larva** (Figs. 30–33)

SIZE: Medium. Measurements (N=10): Body length 6.1; head capsule width 1.41.

CHAETOTAXY (trunk segments only): General secondary dorsal sensilla mostly small and coniform, grading to larger and spiniform laterad; a triplet (short series of 3, rarely 2) of conspicuously larger spiniform sensilla in the anterolateral and posterolateral tergal regions (latter triplet lateral to primary subtergal sensillum, **tp.**). Sensilla of antero- and posterolateral linear series large and spiniform; lateral and ventral members of both series with apices acuminate and sometimes multiple.

STRUCTURE: Pseudopods elongate, L/W about 3.5; arising from near apex of pleuron. Posterolateral lobe of anal division well developed, about half the size of the pseudopods, its apex directed posterolaterad. Lateral margin of anal division entire, set with a few larger spiniform secondary sensilla. Posterior extreme of anal division densely pigmented and heavily sclerotized and separated from posterolateral lobes by a deep depression. Ventral integument mesal to insertion of pseudopod mammillate over a broad area, the mammillae spinose laterad, grading to papillae mesad.

MATERIAL:

COSTA RICA, *San José Province,* 2 miles W Grecia, Río Trojas, 18 June 1972, C.L. Hogue (7 pupae, 24 larvae: LACM). Pan American Highway and Río Cajón, 22 June 1972, C.L. Hogue (11 larvae: LACM). Pan American Highway and Río Unión, 22 June 1972, C.L. Hogue (1 larva: LACM). Rivas, January 1934. D. Rounds (Holotype ♂, 1 paratype ♂: Alexander Collection). 10 miles E San Isidro del General, Río General, 22 June 1972, C.L. Hogue (1 larva: LACM). 1.8 miles S San Isidro del General, Río Pedregoso, 28 June 1972, C.L. Hogue (24 larvae: LACM).

REMARKS

Unfortunately, *delectata* is imperfectly known. The larva and pupa described here, although slightly large for the size of the adult, I judge to belong to this species since they were taken in the same drainage system (Rîo General) from whence the holotype comes (see Fig. 40). However, there are no collections of early stages associated with adults to confirm this.

## *Paltostoma diriageni* NEW SPECIES

Figures 3–4, 15–19, 26, 34–36, 38, 40

DIAGNOSIS

Male genitalic features as follows set this species apart from its relatives: long penis filaments, gradually widening basally; bases of these structures non-alveolate internally. IXth tergite lobe asymmetrically triangular (similar to that of *zwicki* but the two lobes more divergent); arms of ventral armature widely separated anteriorly. Margin of outer dististyle entire.

DESCRIPTIONS

**Male** (Figs. 3, 15–19)

Based on 3 pharate specimens dissected from their pupal cases:

COLORATION: Not determinable.

SIZE: Measurements as follows: wing and leg dimensions not determinable. Head width 1.16. Clypeus-labrum length combined 2.88. Palpal segments 2–3 combined 0.35.

HEAD (Fig. 3): Palpus very short, segments 2–3 fused although limit of former marked by enlarged setae; segment 1 distinct, 2–3 constricted at presumed joint; segment proportions 1:(1:0.5). Antennal segment proportions: 1.0, 1.5, **1.00**, 1.2, 1.3, 1.3, 1.3, 1.2, 1.2, 1.2, 1.3, 1.3, 1.3, 1.4, 1.6; ultimate segment 1.2 length of penultimate.

LEGS: Segment proportions not determinable.

WING: Venation and trichia typical for genus.

GENITALIA (Figs. 15–19): IXth tergite lobe prominent, asymmetrically triangular, apex broadly acute; arms of ventral armature widely disjunct anteriorly. Margin of outer dististyle entire, roughly pentagonal. Inner dististyle simple, apex constricted, a ventromesal lobe present subapically; apicoventral lobe digitate, pronounced. Tegmen with narrow base, apex spatulate, basal portion broad, articulating laterally with the disjunct arms of the ventral armature of the IXth tergite lobes. Phallosome lacking parameres, complex striae evident in ventral plate; penis filaments long, evenly tapered, only slightly widened basad, extreme basal portions non-alveolate internally.

**Female** (Figs. 4, 26)

Based on 4 pharate specimens dissected from their pupal cases:

COLORATION: Not determinable.

SIZE: Measurements as follows: Wing and leg dimensions not determinable. Head width 1.19. Clypeus length 0.57. Labrum length 1.08. Palpal segments 2–3: 0.27, 0.44.

HEAD: Palpus very short, segments 1–3 distinct, proportions 2–3: 1.0, 1.6. Antennal segment proportions: 1.2, 1.2, **1.00**, 1.2, 1.3, 1.2, 1.1, 1.1, 1.0, 1.0, 1.1, 1.0, 1.1, 1.3; ultimate segment 1.2 length of penultimate.

LEGS: Segment proportions not determinable.

WING: Venation and trichia typical for genus.

GENITALIA (Fig. 26): Oviscapt elongate, ratio L/W=1.8. Setae of VIIIth sternite lobe long, 22–31 in number.

**Pupa** (Fig. 38)

SIZE: Large. Measurements (N=10): male length 6.7, width 4.4; female length 7.2, width 5.0.

STRUCTURE: Outline elliptical, L/W 1.4–1.5, compressed, cross section hemilenticular, peripheral margin acute. Cephalic sclerite underfolded only slightly more than half the distance to level of tips of palpus case. Anterior margin of scutellar sclerite shallowly V-shaped. Cuticular spines proportionately short, longest lateral spines distinctly less (about 0.75) than mid-dorsal length of scutellar sclerite; numerous spines in mesoposterior region of scutum, parabasal spinelets commonly multiple (2–4) and of unequal length. Lamellae of respiratory processes parallel, erect, subequal in length; outer pair heavier than inner and triangular, inner pair 0.6–0.7 width of outer at their bases; no. 3 the smallest and narrower than no. 2 and set mesad of same; apices of both inner lamellae slightly recurved but neither bent tortuously.

**Larva** (Figs. 34–36)

SIZE: Large. Measurement (N=10): body length 6.3; head capsule width 1.69.

CHAETOTAXY (trunk segments only): General secondary dorsal sensilla all small and coniform; those of antero- and posterolateral linear series much larger than general dorsals; cylindriform mesally, becoming coniform, flattened and sometimes ridged, laterally.

STRUCTURES: Pseudopods short, L/W about 2.3; arising from ventrolateral depression. Posterolateral lobe of anal division well developed, only slightly smaller than pseudopods, apex directed posterolaterad. Lateral margin of anal division with a conspicuous lobe anterior to posterolateral lobe, set with an arc of large, ovate sensilla. Posterior extreme of anal division densely pigmented and heavily sclerotized and separated from posterolateral lobes by a deep incision. Ventral integument mesal to base of pseudopod mammillate over a broad area, mammillae spinose laterad, grading to papillae mesad.

MATERIAL AND TYPE LOCALITY:

*Types.* COSTA RICA, *Alajuela Province,* Río Angel below El Angel Falls, 13 April 1975. C.L. Hogue: HOLOTYPE ♂ (pharate, dissected from and associated with pupal case; in alcohol: genitalia on slide No. CLH 75–219; head on slide No. CLH 75–233: LACM); ALLOTYPE ♀ (as ♂: genitalia on slide No. CLH 75–221; head on slide No. CLH 76–158: LACM); 3 ♂, 1 ♀ PARATYPES (pharate adults in alcohol, dissected from pupal cases with genitalia and heads on slides: LACM).

*Additional.* COSTA RICA, *Alajuela Province,* Río Angel below El Angel Falls, 13 April 1975, C.L. Hogue (19 ♂, 31 ♀ pupae and sexed whole pupal skins; 15 fragmentary pupal skins; 2 larvae: LACM). *Puntarenas Province,* Las Cruces, (rock quarry) 6 miles S San Vito de Jabá, Río Jabá, 27 June 1972, C.L. Hogue (1 pupa, 1 larva: LACM). 1.8 mi. W Rincón, Linguita Creek, 3 July 1963, C.L. Hogue (1 ♀, pharate, dissected from pupal case; 1 pupa, 3 partial pupal skins, 10 larvae: LACM). 11 March 1971, C.L. Hogue and J.P. Donahue (2 pupae, 2 larvae: LACM). *San José Province,* 2 miles W Grecia, Río Trojas, 18 June 1972, C.L. Hogue (1 pupa: LACM). 12.5 miles N San Isidro del General, 15 June 1963, C.L. Hogue (7 larvae: LACM).

ETYMOLOGY: The name was chosen to commemorate the name of one of Costa Rica's most famous and clever caciques. In 1522, Diriagen is reputed to have nearly defeated a force led by Gonzalez Davila in an ambush into which the latter's greed for Indian treasure led him.

## ***Paltostoma exserta*** NEW SPECIES

Figures 10–11, 39, 40

DIAGNOSIS

This species is distinct from all other known *Paltostoma* in the form of the pupal lamellae. Normally the four plates of the branchia are more or less separate from one another and about equal in length (although the inner two may be narrower than the outer), but in *exserta* the inner pairs are appressed by the outer and extend about 20% of their own length beyond them.

Only small differences exist in other features, notably in the male genitalia, between *exserta* and the very similar *diriageni.* This applies principally to the shape of the inner dististyle which is considerably broader in the former than in the latter species. This structure also has a less pronounced apicoventral lobe in *exserta* than in *diriageni.* A further difference may be found in the outer dististyle lobe which is smoothly rounded in shape in *exserta* while it is asymmetrically hexagonal in *diriageni.*

The larva of *exserta* is unknown.

DESCRIPTIONS

**Adults**

The great similarity of this species to *diriageni* (see above) makes a full description of the adults superfluous. From the small amount of material available, which consists entirely of pharate individuals dissected from their pupal cases, nothing can be detected to distinguish the females. The same is true of the males except for a few characteristics in the genitalia. The latter are described as follows from the single fairly well sclerotized, but pharate, specimen:

MALE GENITALIA (Figs. 10–11): IXth tergite lobe prominent, asymmetrically triangular, apex broadly acute; arms of ventral armature widely disjunct anteriorly. Margin of outer dististyle entire, oval; dorsal portion concave. Inner dististyle simple, broad and angular, a ventromesal lobe present subapically; apicoventral lobe acute and moderately pronounced. Tegmen with narrow base, apex spatulate; basal portion broad, articulating laterally with the disjunct arms of the ventral armature of the IXth tergite lobes. Phallosome lacking parameres, complex striae evident in ventral plate; penis filaments long, evenly tapered, only slightly widened basad; extreme basal portions of filaments non-alveolate internally.

**Pupa** (Fig. 39)

SIZE: Large. Measurements: male (N=3) length 5.9, width 4.4; female (N=7) length 7.0, width 5.0.

STRUCTURE: Outline elliptical, L/W 1.4. Cuticular spines proportionately short, longest lateral spines distinctly less (about 0.75) than mid-dorsal length of scutellar sclerite; condition of parabasal spinelets not determinable due to abraded condition of available material. Branchial lamellae compressed, outer pair much heavier than inner and triangular, appressed to inner pair which are sagittate in form and extend considerably beyond the apices of the outer pair (by about 20% of their total length); outer lamellae covered by a dense, white, flocculent material of unknown origin.

**Larva**

Unknown.

MATERIAL AND TYPE LOCALITY:

*Types.* COSTA RICA, *Alajuela Province,* Río Angel below El Angel Falls, 13 April 1975, C.L. Hogue: HOLOTYPE ♂ (pharate, dissected from and associated with pupal case; in alcohol: genitalia on slide No. CLH 77–1; head on slide No. CLH 77–10: LACM); ALLOTYPE ♀ (as ♂: genitalia on slide No. CLH 77–3: LACM); 3 ♀ PARATYPES (pharate adults in alcohol, dissected from pupal cases with genitalia and heads on slides: LACM).

*Additional.* COSTA RICA, *Alajuela Province,* Río Angel below El Angel Falls, 13 April 1975. C.L. Hogue (2 ♂, 8 ♀ pupae: LACM).

ETYMOLOGY: *Exserta* is Latin, meaning "extended beyond" and is in reference to the protruding middle branchial lamellae of the pupa.

## *Paltostoma zwicki* NEW SPECIES

Figures 20–24, 40

DIAGNOSIS

The following characteristics of the male genitalia distinguish this new species from its congeners: short penis filaments with basal third abruptly widened and alveolate internally. IXth tergite lobe asymmetrically triangular with an acute apex, arms of ventral armature contiguous anteriorly. Outer dististyle incised apicoventrally.

DESCRIPTIONS

**Male** (Figs. 20–24)

Based on the holotype and a single male paratopotype:

COLORATION: *Head.* — All sclerites medium-brown, darker towards vertex and caudad, with extensive velvety texture and silvery opalescent reflections; ocellar triangle dark-brown. Mouthparts and antenna dull brown, the latter darker. *Thorax.* — Generally medium-brown. Scutum, scutellum, episternum and meron darker and with reflections as on head; remaining sclerites dull yellow-brown. *Legs.* — Generally dull gray-brown, lighter basad, becoming darker distad; tarsi, including claws, almost black. Apices of femora darkened. *Wing.* — Membrane hyaline, veins brownish-black. *Haltere.* — Stem yellow basad, darkening distad; knob velvety brown. *Abdomen.* — Basal half of first tergite yellow, the remainder of this and other tergites velvety-brown with silvery reflections caudad, a distinct reflective black band basally. Sternites light-brown, also reflective. *Genitalia.* — Dark brown.

SIZE: Measurements as follows (from combined material, maximum N=2): Body length not determinable. Wing length 5.0, width 1.7. Head width 0.82. Clypeus length 0.23. Labrum length 1.66. Palpal segments 1–3 combined 0.21, 2–3 combined 0.15, 2 alone 0.06. Leg segment lengths as below (from Pedregosa specimen):

| | fore | mid | hind |
|---|---|---|---|
| femur | 3.3 | 4.2 | 5.0 |
| tibia | 3.9 | 4.1 | 4.8 |
| tarsus 1 | 1.38 | 1.43 | 1.56 |
| 2 | 0.59 | 0.68 | 0.46 |
| 3 | 0.34 | 0.38 | 0.24 |
| 4 | 0.23 | 0.24 | 0.20 |
| 5 | 0.28 | 0.29 | 0.26 |

HEAD: Palpus very short, segments 2–3 fused, segment 1 distinct, 2–3 constricted at presumed joint; segment 2 short; proportions: 1:(1:1.4). Antennal segment proportions (from Pedregosa specimen, segments 9–14 damaged): 1.7; 1.7, **1.00**, 1.3, 1.3, 1.4, 1.3, 1.3, 1.3, 1.4, 1.1, 1.4, 1.3, 1.3, 1.9; ultimate segment 1.5 length of penultimate.

LEGS: Progressive segment proportions as below:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| foreleg | 1.0 | 1.2 | 0.4 | 0.4 | 0.6 | 0.7 | 1.2 |
| midleg | 1.0 | 1.0 | 0.4 | 0.5 | 0.6 | 0.6 | 1.2 |
| hindleg | 1.0 | 1.0 | 0.3 | 0.3 | 0.5 | 0.8 | 1.3 |

WING: Venation and trichia typical for genus.

GENITALIA (Figs. 20–24): IXth tergite lobe prominent, asymmetrically triangular, apex broadly acute; arms of ventral armature contiguous anteriorly. Outer dististyle incised apicoventrally, ventromedian margin not markedly produced. Inner dististyle slightly expanded apicad, apex abruptly narrowed and attenuate. Tegmen broad, apex rounded with a median, narrow sclerotized shaft; basal portion narrow, articulating with the contiguous arms of the ventral armature of IXth tergite lobes. Phallosome with slightly sclerotized straps in center of ventral plate, suggesting rudimentary parameres; penis filaments short, basal third abruptly widened, this portion alveolate internally.

**Female, pupa** and **larva**

Unknown.

MATERIAL AND TYPE LOCALITY:

*Types.* COSTA RICA, *San José Province,* Turrialba, 5–15 March 1954, C.H. Batchelder: HOLOTYPE ♂ (genitalia on slide No. CLH 76–161: USNM); PARATYPE ♂ (genitalia on slide No. CLH 76–162: USNM). March 1954. C.H. Batchelder (light trap).

*Additional.* COSTA RICA, *Province Unknown,* Pedregosa, no date, D.L. Rounds (1 ♂: USNM).

ETYMOLOGY: The species is named in honor of Peter Zwick, distinguished student of the family Blephariceridae.

REMARKS

I have not been able to locate the locality "Pedregosa" of Rounds' collection; it may be Pedregoso, 1 km W San Isidro del General.

## ACKNOWLEDGMENTS

I owe gratitude to the following persons for making available the material upon which this report is based, either by providing funds and special help in the field, or by loaning specimens: Charles P. Alexander, John E.S. Dockweiler, Julian P. Donahue, Alan Landsburg, and Peter Zwick.

I would like to acknowledge also the invaluable assistance of Betty Birdsall and Carol Madle with preliminary drawings and to thank particularly Joy Roan for her fine rendering of figures of the larvae (Figs. 27–36).

## RESUMEN

Se hace referencia a cinco especies de mosquitos de alas reticuladas de la familia Blephariceridae, procedentes de Costa Rica. Las cinco especies pertenecen al género *Paltostoma;* con excepción de *P. delectata* Alexander, ya descrita, las cuatro restantes *(costaricensis, diriageni, exserta* y *zwicki)* se describen como nuevas especies. La publicación incluye además un diagnóstico, acompañado de notas biológicas, referentes al género.

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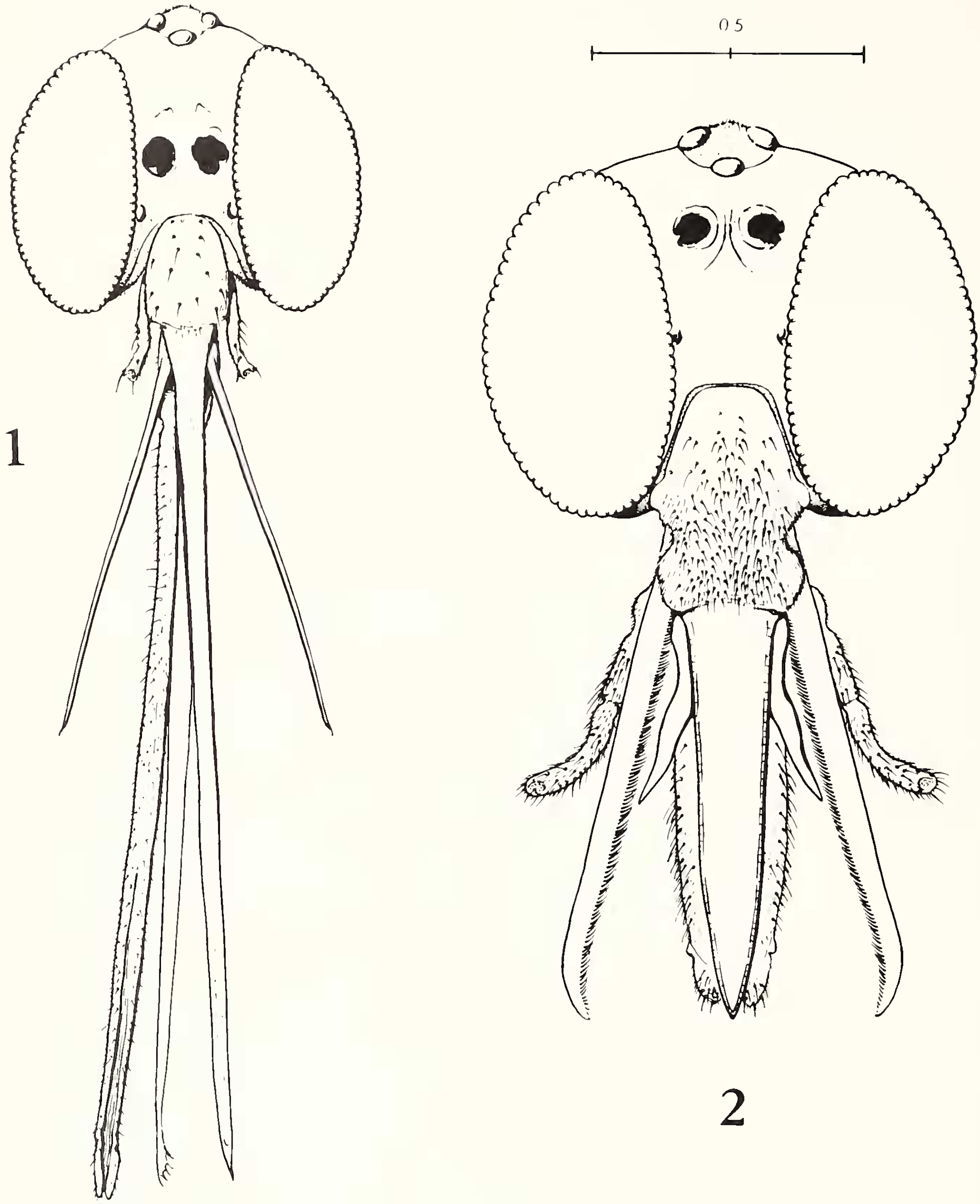
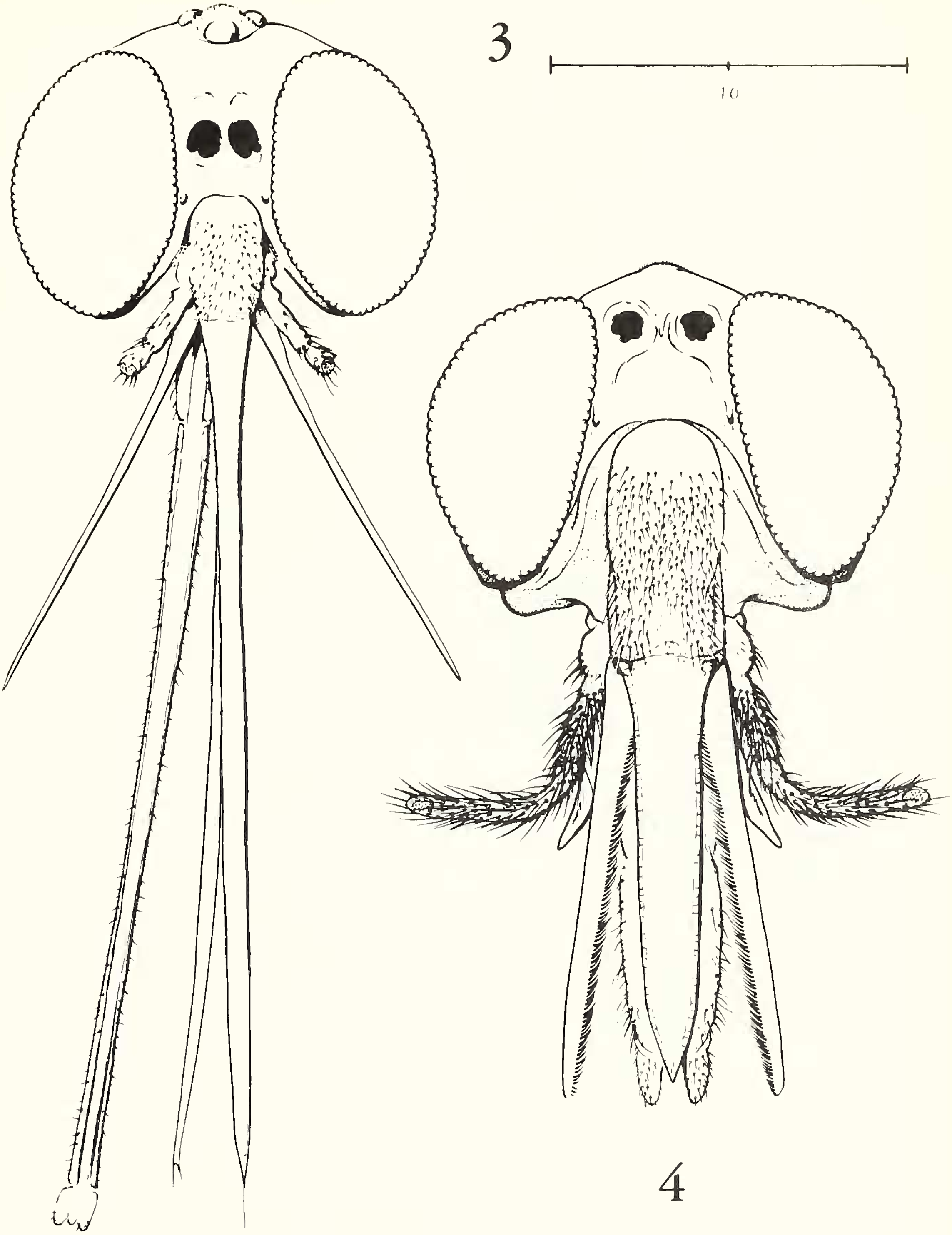
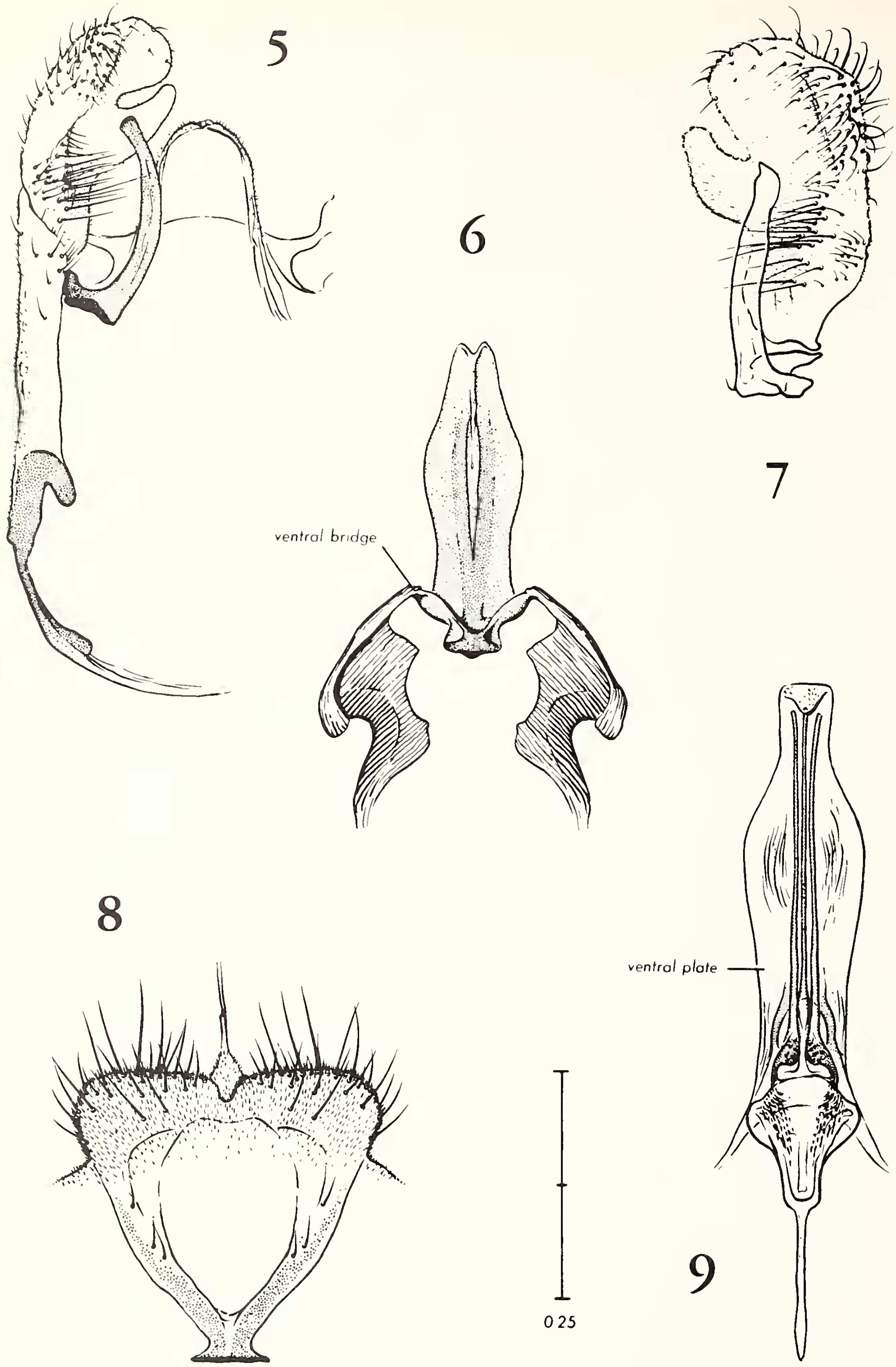


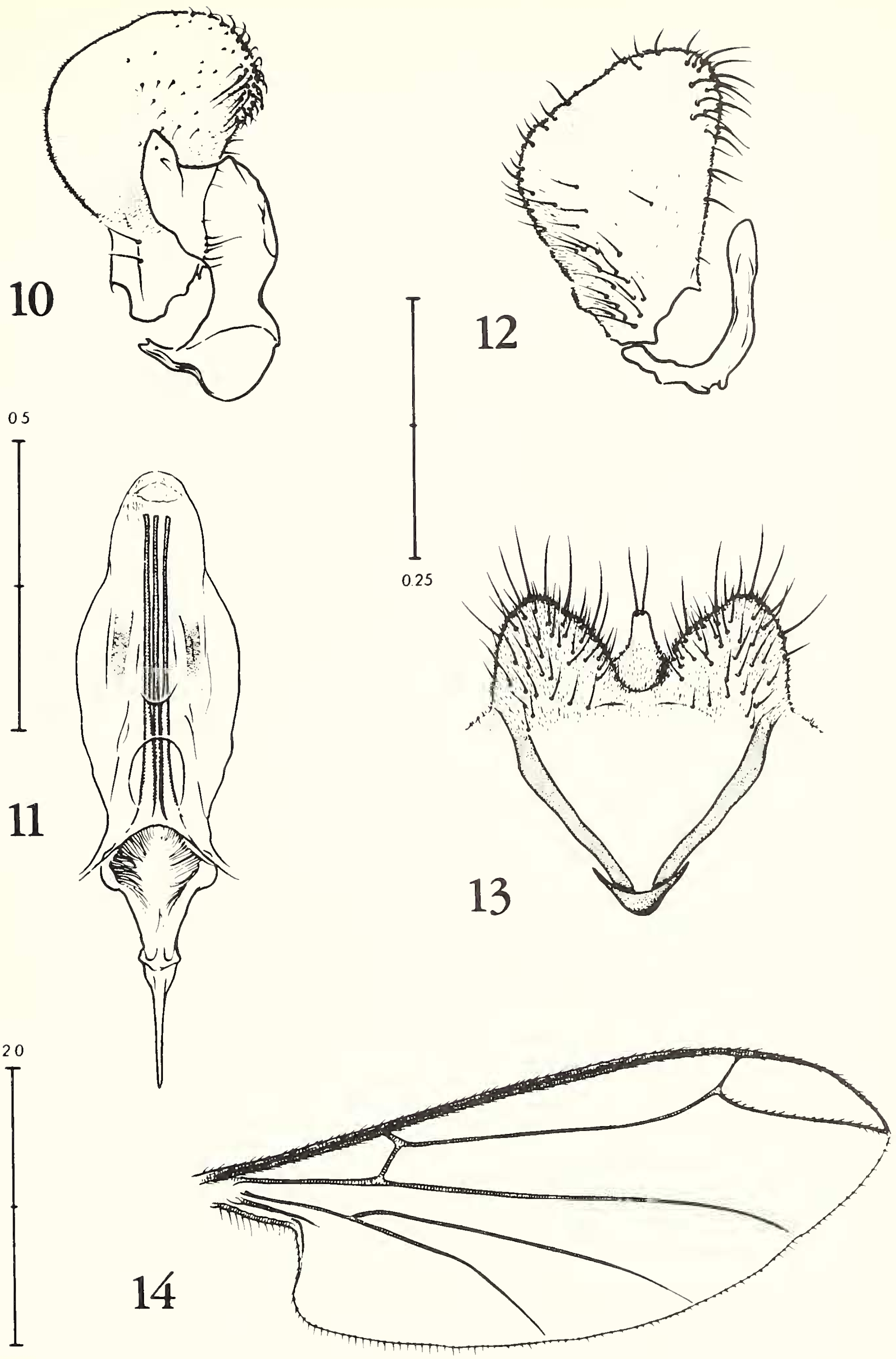
FIGURES 1–2. *Paltostoma costaricensis*, heads in frontal aspect. 1, male. 2, female.



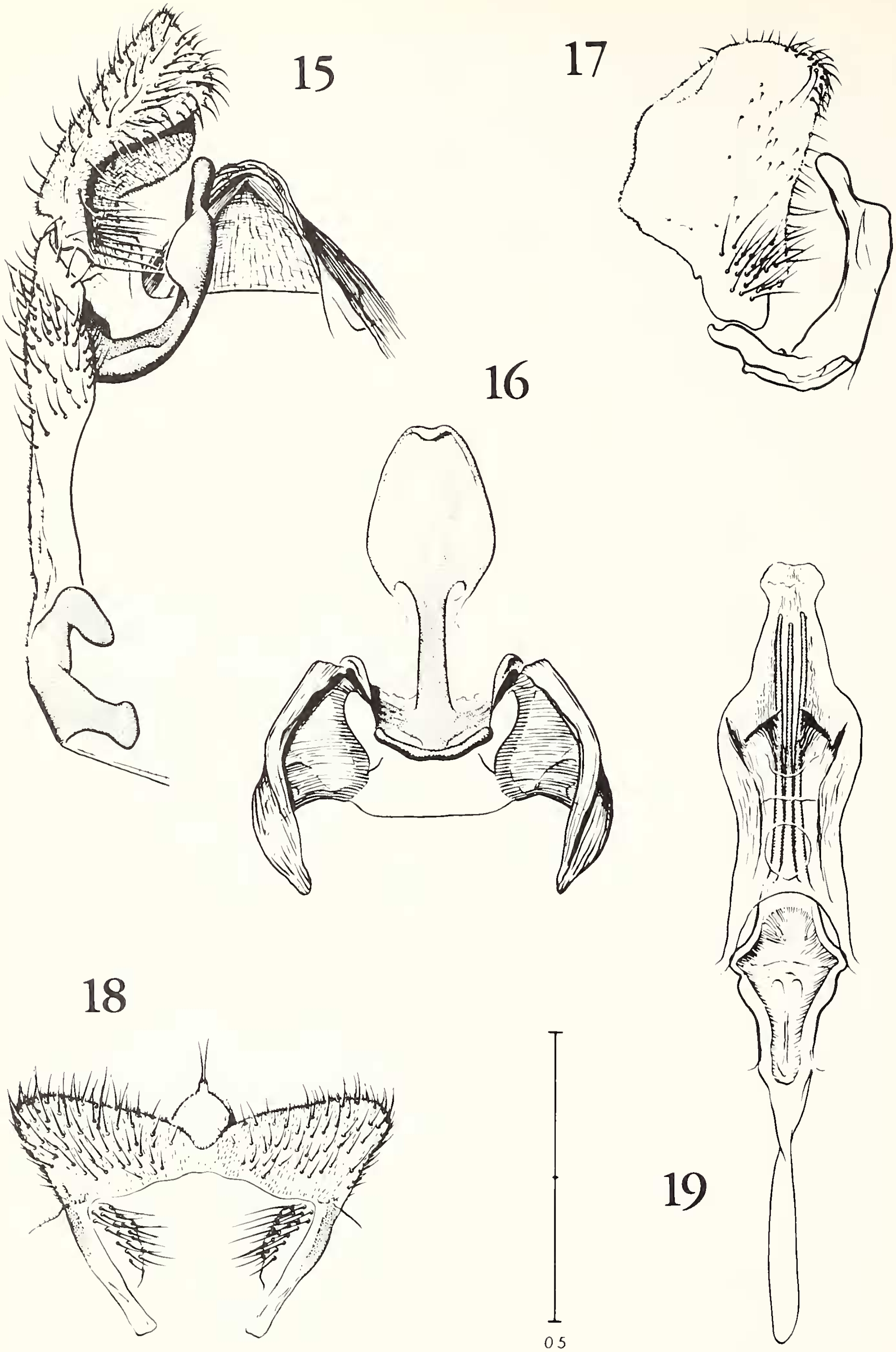
FIGURES 3–4. *Paltostoma diriageni,* heads in frontal aspect. 3, male. 4, female.



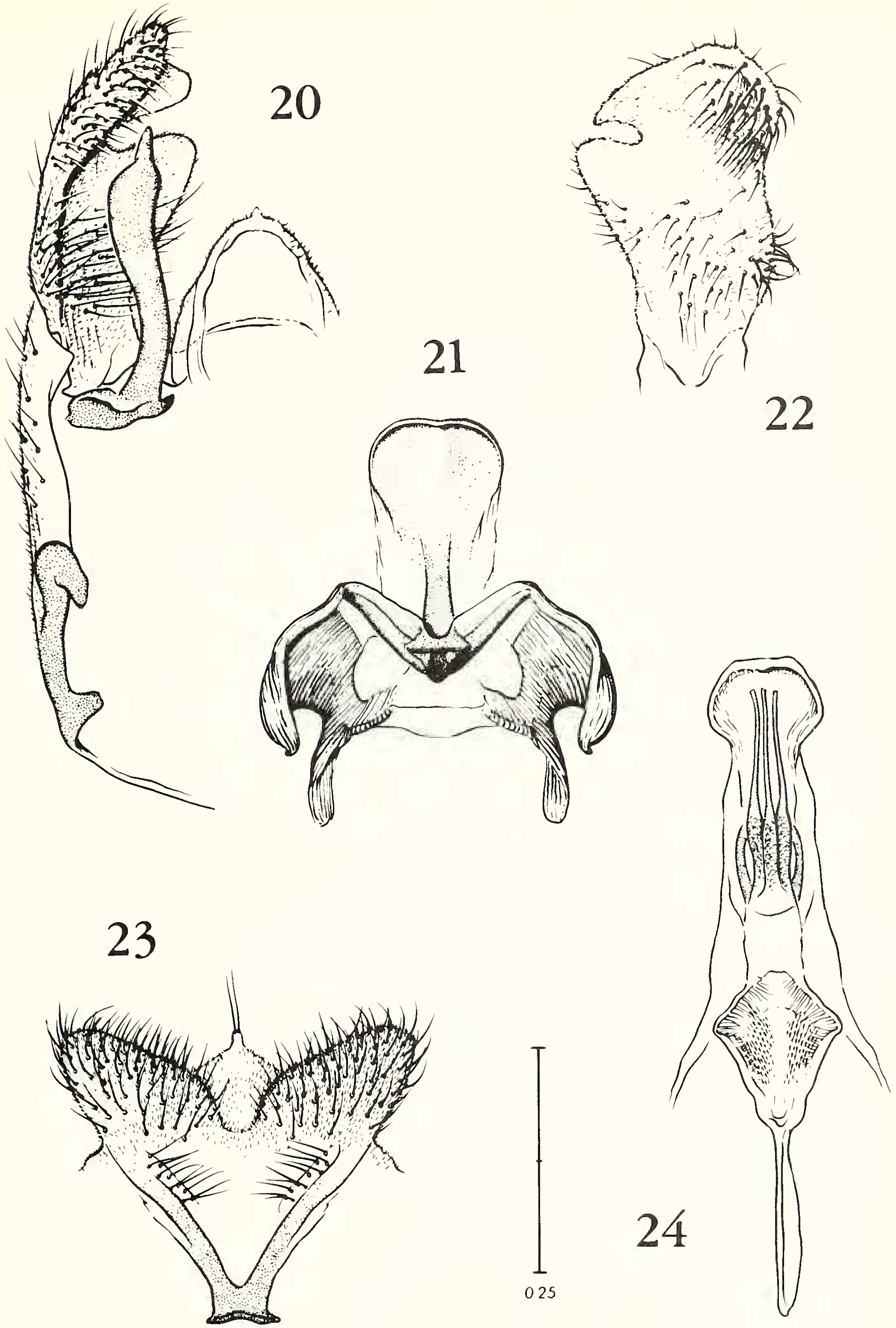
Figures 5–9. *Paltostoma costaricensis*, male genitalia. 5, basistyle, dististyle and associated structures, dorsal aspect. 6, tegmen and ventral bridge. 7, right dististyle, inner aspect. 8, IXth tergite lobes and ventral armature. 9, phallosome and ventral plate.



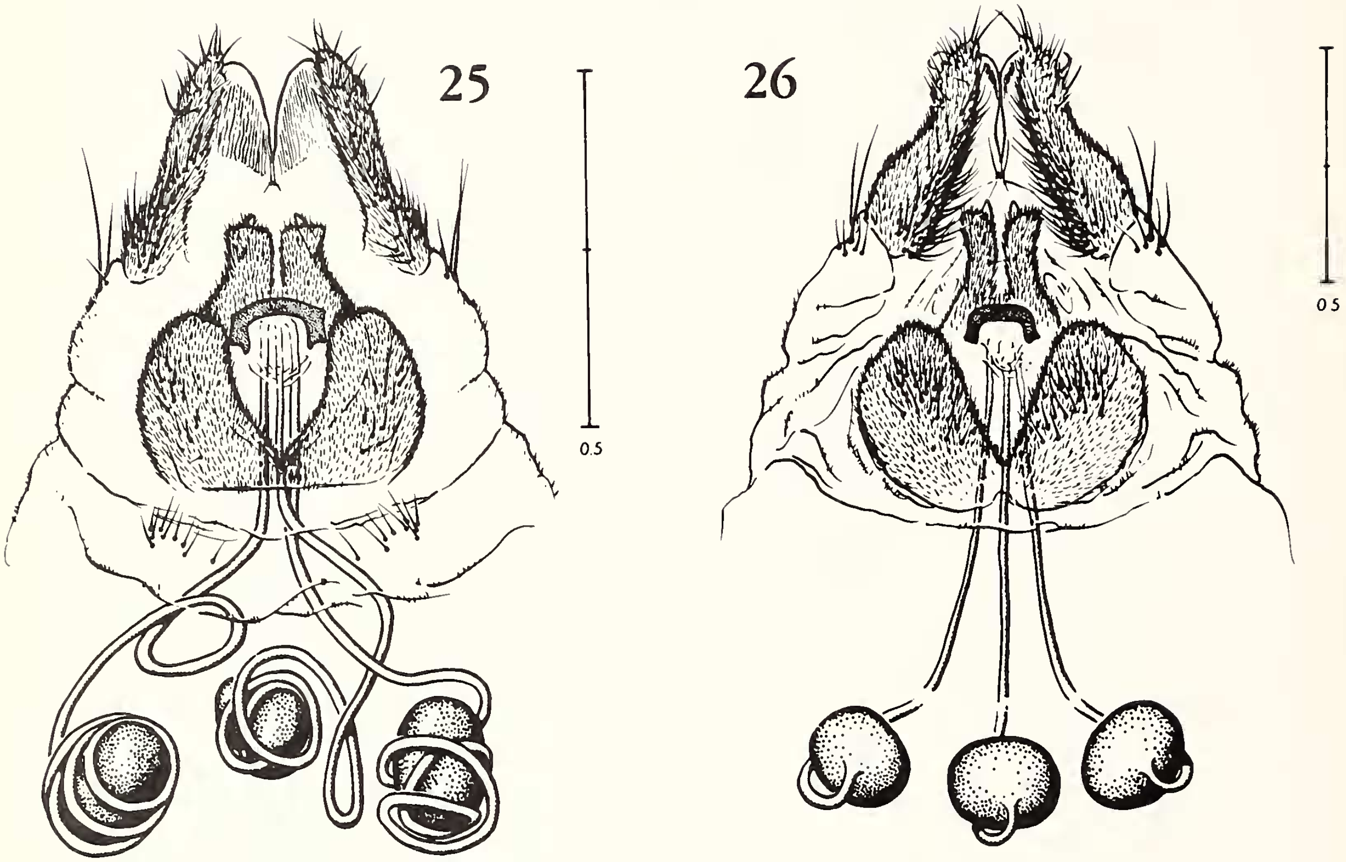
FIGURES 10–14. *Paltostoma*, male genitalia and wing. 10–11, *P. exserta*. 10, right dististyle, inner aspect. 11, phallosome and ventral plate. 12–14, *P. delectata*. 12, right dististyle, inner aspect. 13, IXth tergite lobes and ventral armature. 14, wing.



FIGURES 15–19. *Paltostoma diriageni,* male genitalia. 15, basistyle, dististyle and associated structures, dorsal aspect. 16, tegmen and ventral bridge. 17, right dististyle, inner aspect. 18, IXth tergite lobes and ventral armature. 19, phallosome and ventral plate.



FIGURES 20–24. *Paltostoma zwicki,* male genitalia. 20, basistyle, dististyle and associated structures, dorsal aspect. 21, tegmen and ventral bridge. 22, right dististyle, inner aspect. 23, IXth tergite lobes and ventral armature. 24, phallosome and ventral plate.



FIGURES 25–26. *Paltostoma,* female genitalia, ventral aspect. 25, *P. costaricensis.* 26, *P. diriageni.*

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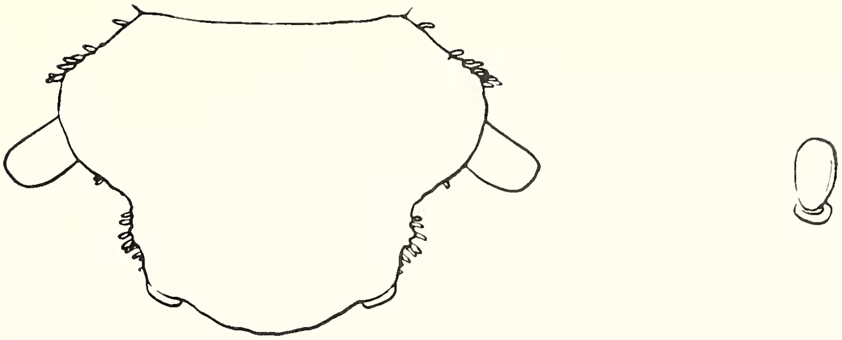

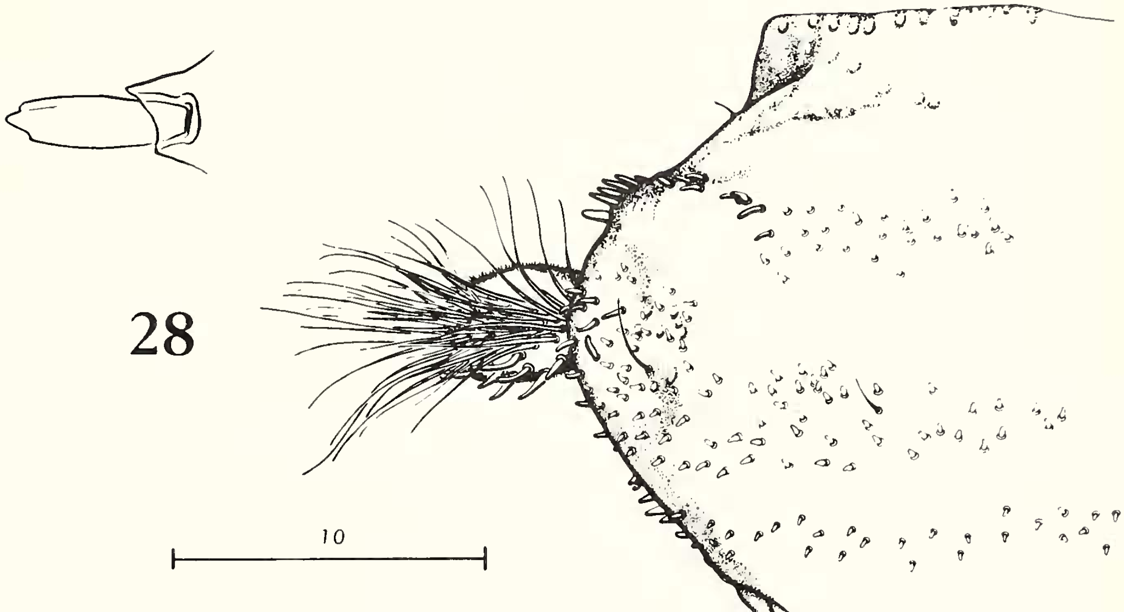

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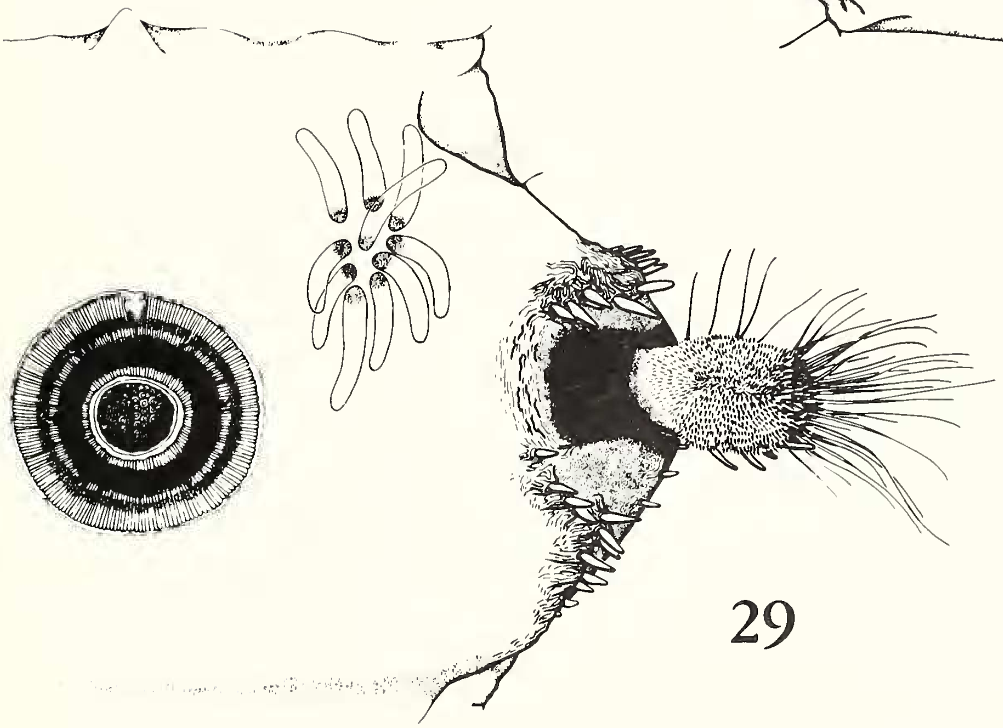

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FIGURES 27–29. *Paltostoma costaricensis*, larva. 27, anal division, outline. 28, trunk division II, dorsal aspect. 29, same, ventral aspect.

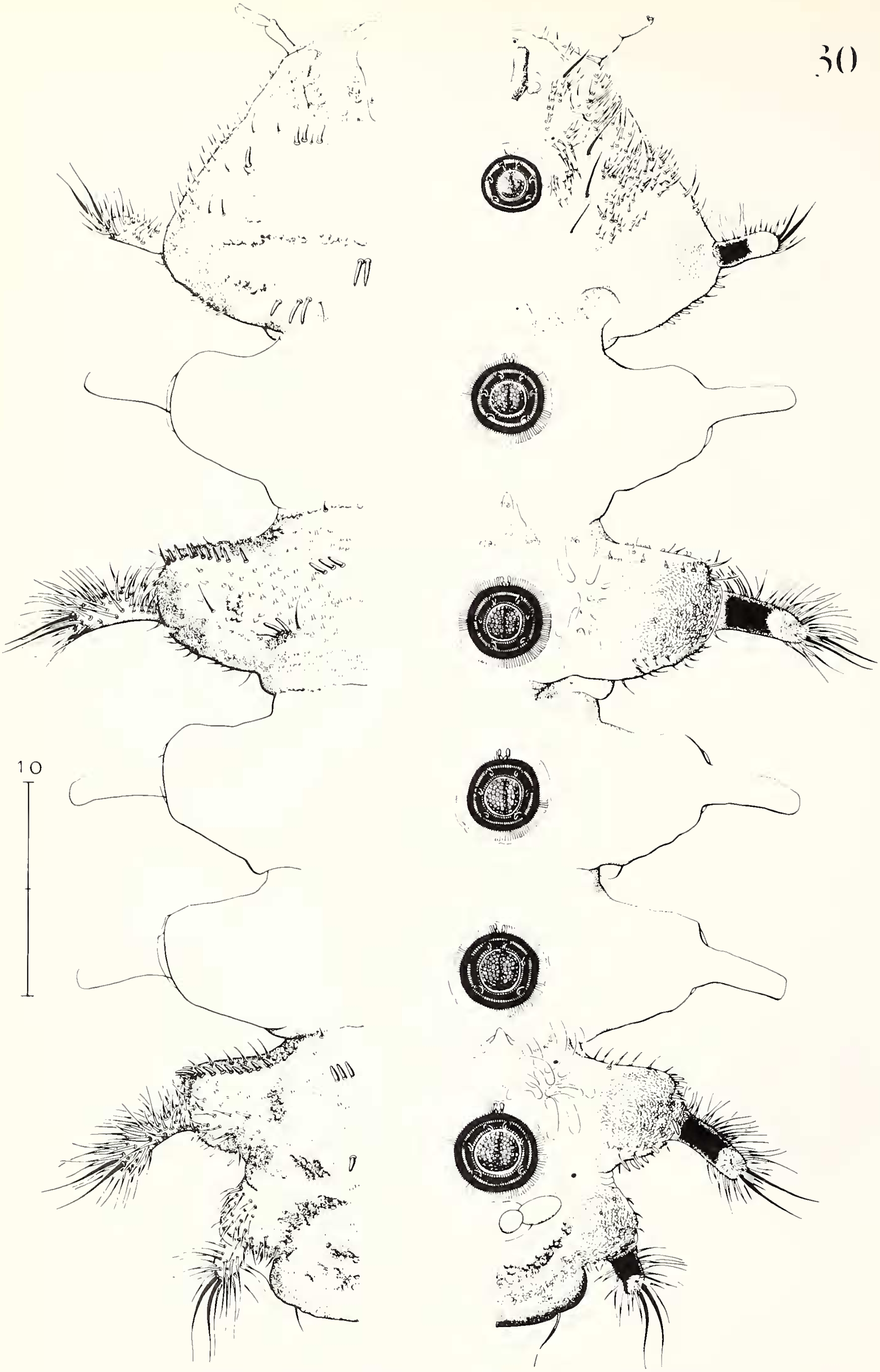

FIGURE 30. *Paltostoma delectata*, larva, dorsal aspect, left; ventral aspect, right.

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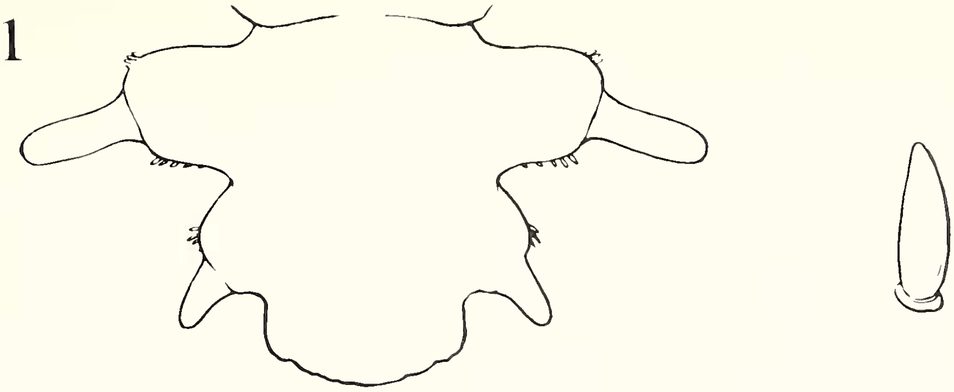

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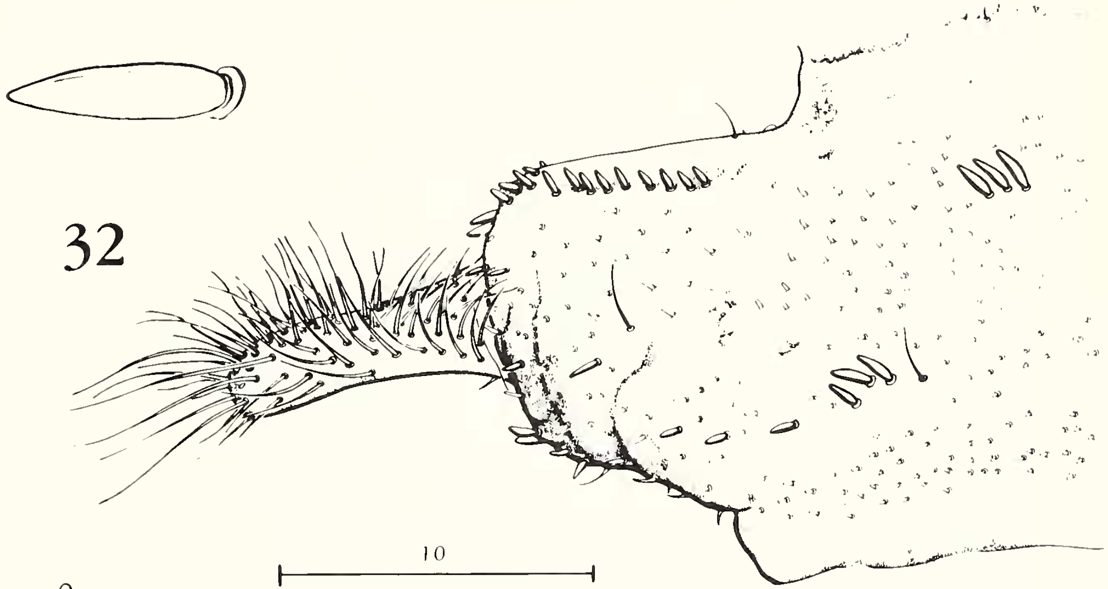

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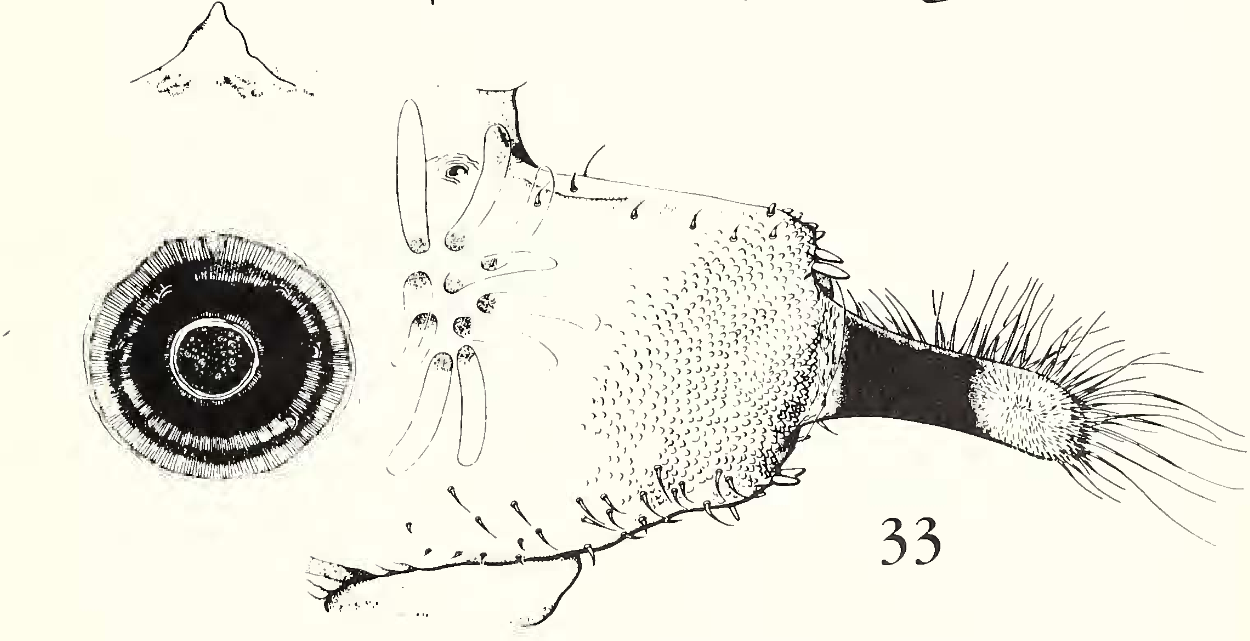
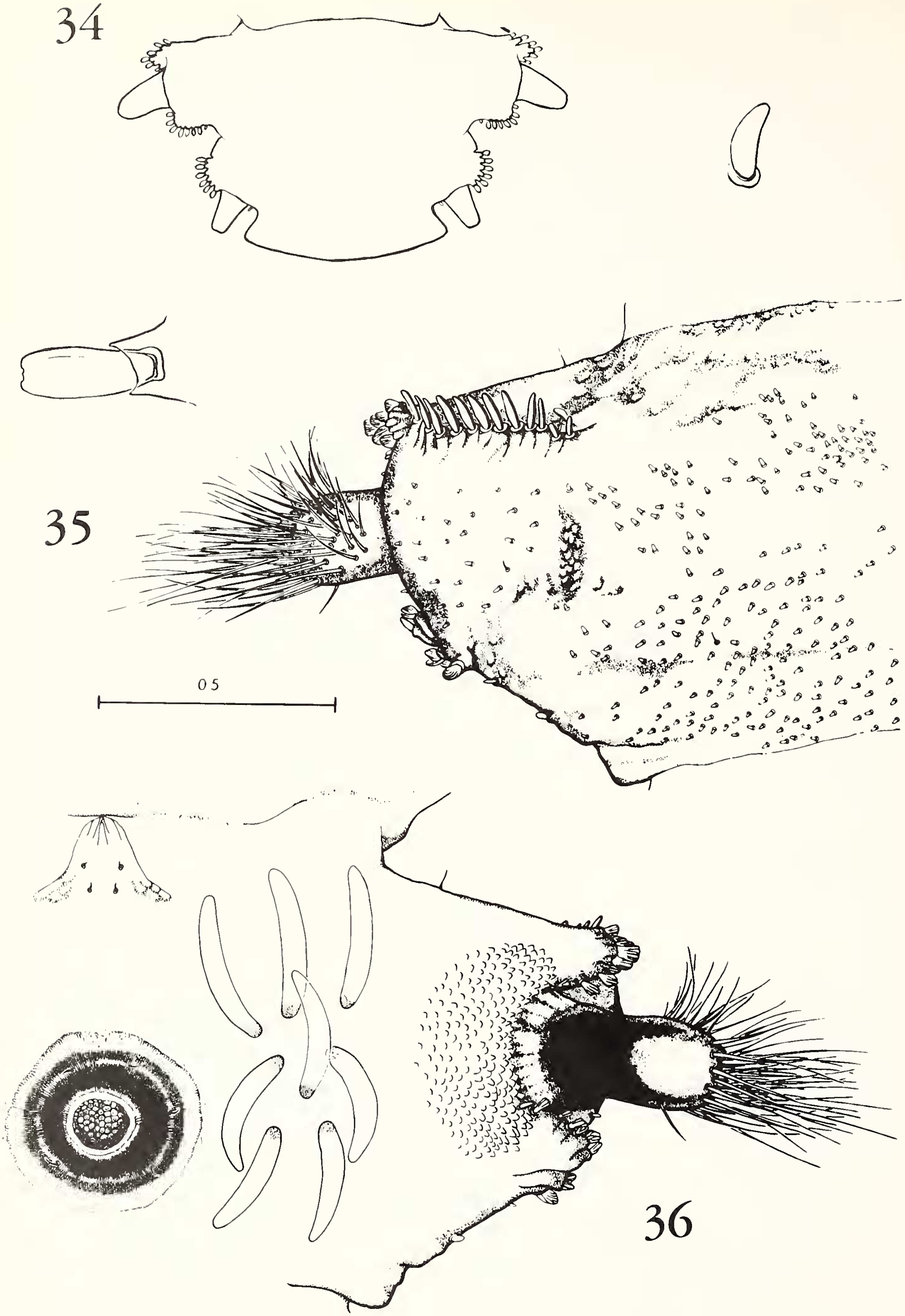
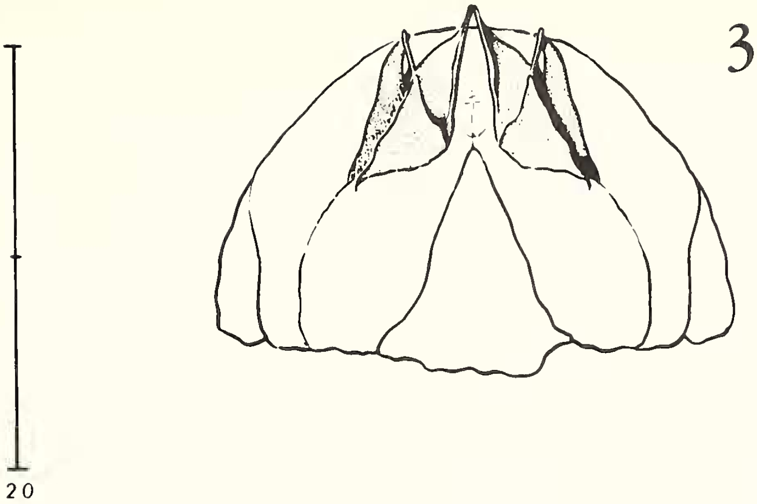


FIGURES 31–33. *Paltostoma delectata*, larva. 31, anal division, outline. 32, trunk division II, dorsal aspect. 33, same, ventral aspect.



Figures 34–36. *Paltostoma diriageni*, larva. 34, anal division, outline. 35, trunk division II, dorsal aspect. 36, same, ventral aspect.



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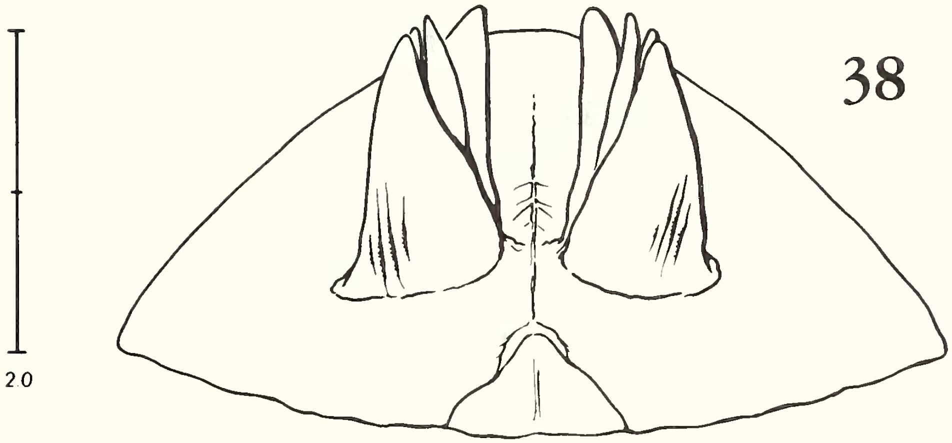

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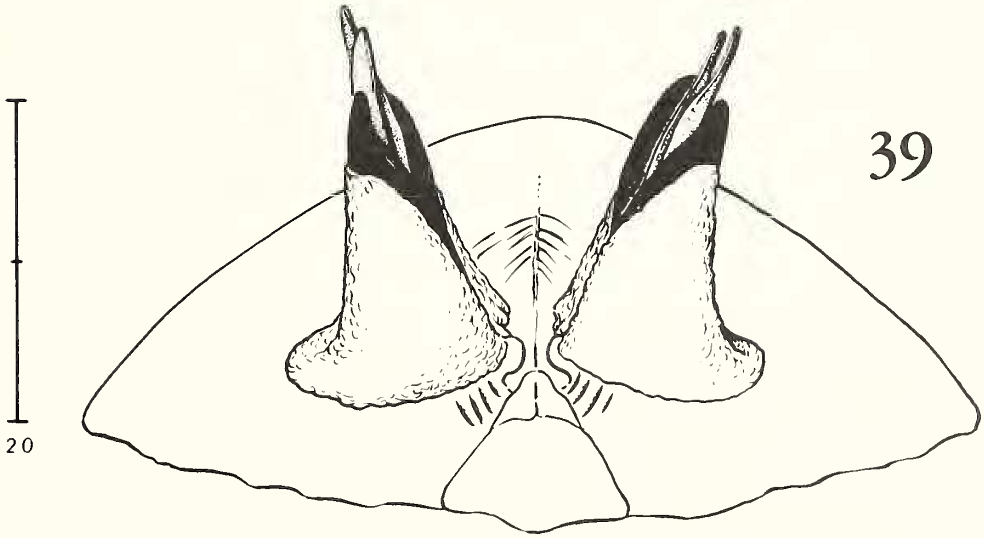

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**Figures** 37–39. *Paltostoma*, pupae, anterior aspect. 37, *P. costaricensis*. 38, *P. diriageni*. 39, *P. exserta*.

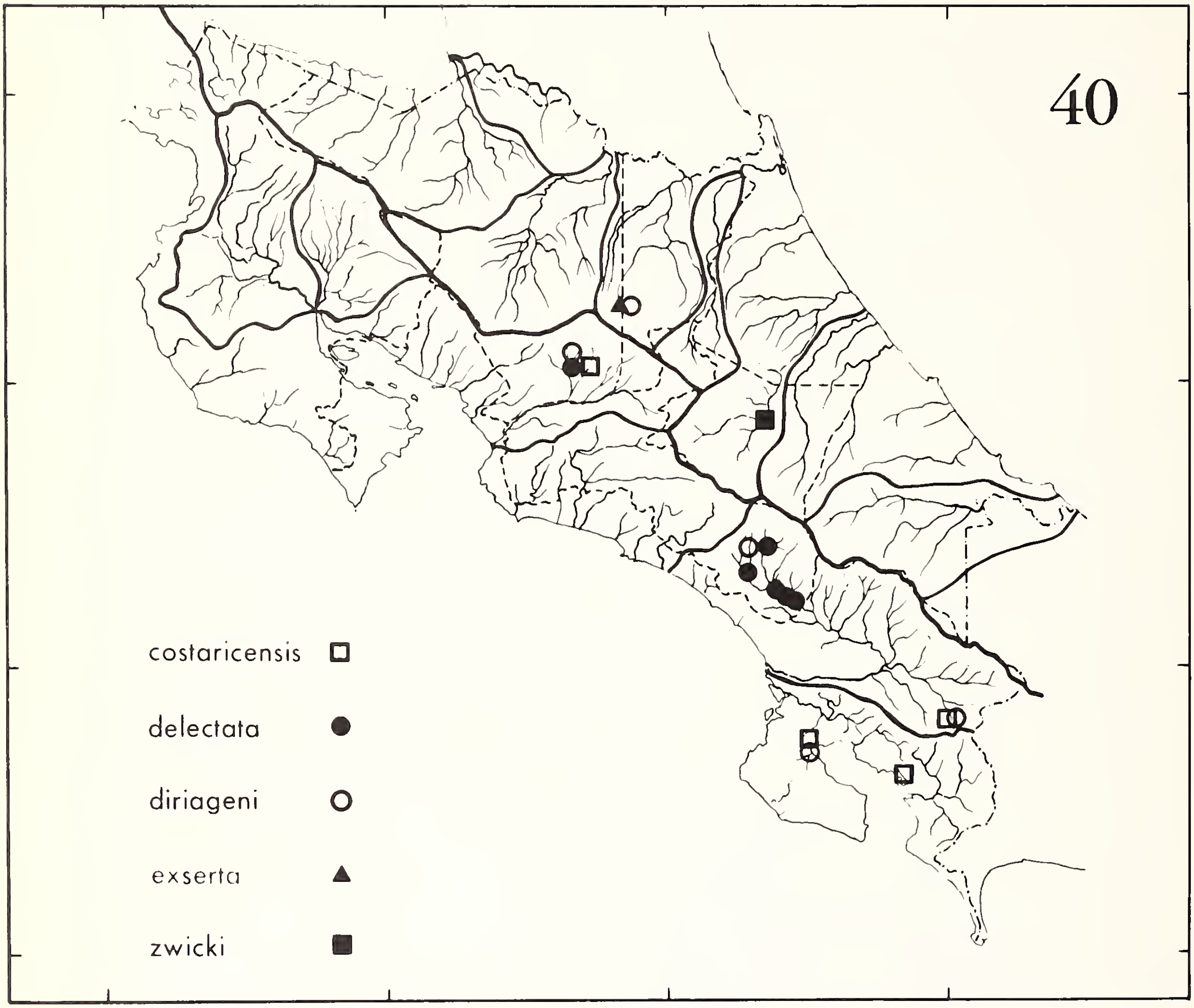

FIGURE 40. Map of Costa Rica with collection localities of *Paltostoma* shown by symbols. Heavy lines outline major drainage systems, heaviest indicating continental divide.